Roma, 23/9/98

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IHRA Working Group on Advanced offset frontal crash protection

Please find here enclosed the minutes of the third meeting of the Working Group, held in Rome on 14 - 15th September 98.

Yours sincerely

Claudio Lomonaco

INTERNATIONAL HARMONIZED RESEARCH AGENDA (I.H.R.A.)

Rome, 18/9/98

STATUS REPORT ON THE ADVANCED OFFSET FRONTAL CRASH PROTECTION GROUP
(Based on the results of the meeting held in Rome on 14 - 15th September 1998)

Participants: C. Lomonaco (Chairman, Ministry of Transport of Italy), R. Lowne (EEVC), A. Lie (EEVC), K. Seyer (Federal Office of Road Safety Australia), A. Hobbs (IHRA Compatibility), T. Hollowell (NHTSA), D. Dalmotas (Ministry of Transport of Canada), K.Oki (JAMA), P. Fay (ACEA/OICA), E. Gianotti (Secretary of the group).

INTRODUCTION.

The chairman resumed to the participants the task of the group and with reference to the agenda the scope of the meeting.
The chairman remembered to the group that time is coming to finalize the goal of an harmonized standard on the matter. The test research are in progress in all the country involved in the IHRA program and each member has taken since the beginning the commitment to develop a specific item. Accordingly each participants has been invited by the chairman to enlighten the group about the state of the art on each own specific research.

Australia introduced a document (released by the secretariat as IHRA AFC-8) to provide an overview on the state of the art on the frontal impact research in the various part of the world.

The delegate from NHTSA anticipated his report in proposing an internet web page on the topic, to allow an exchange of information among the members of the group. The proposal has been accepted by all the members.

DISCUSSION

1) The two steps approach

Since the beginning of the discussion a two step approach to future frontal requirements has been confirmed by the group. Anyway several comments and suggestion about each of this step has been pointed out by the participants.

Mr. Lowne advocated that EEVC is not a political regulatory body, so in pursuing his research it has been assumed that EEVC might upgrading the frontal impact standard in items concerning dummy (female dummy) and performance criteria.
About the first step, EEVC delegate came up that only one test focused on 5% dummy is limited because it should reduce the safety of other size category of occupants. Namely , the adoption of a fifth percentile dummy in either of the seating positions, in place of the standard fiftieth percentile dummy, would lead to a reduced level of protection in comparison with the current test condition and therefore EEVC would not be in favor of considering this.
At this aim Mr. Lowne released the report on EEVC Activities in Support of IHRA Tasks, that was numbered as IHRA AFC-9.

Anyway two tests rise different questions, because all crash test approval have just one test in Europe. So the question was about the advantages of a two tests approval in Europe

More concerned about the relevant safety issue in north America of this recent spell, namely the air-bag casualties, Mr. Dalmotas said that 5th % female are in most cases killed by air-bag. So he argued that focus on 5th% is a safety improvement for cars.

The delegate from Australia put forward the use of a smart air-bag in order to reduce the risk of an air-bag. Anyway the proposal seemed controversial to the group and the OICA delegate argued that it is difficult to combine into a legislation requirements concerning the deployment, the seat position, the occupant size the effect of the tension limiter, pre-loader and out of position.

Mr. Hobbs continued the discussion asking to the group which kind of dummy should be part of the two test in order to minimize the risk of an air-bag. Such a task is not easy to cope with. The European legislation implies the use of belts, but there are specific reality were belts are disregarded by users.

Also Australia raised the same problem for taxi driver, who are not required to wear belts in the state of New South Wales. There has been a case of an unrestrained taxi driver suffering severe neck injuries in a crash when the airbag deployed. The restrained passenger was uninjuried.

NHTSA enlighten to the group the way which more likely intends to pursue for the first phase:
A sure first test with a 5th % female dummy with a test speed of 40 km/h and a likely second test using a 95th% male dummy at 60km/h to cover the risk of Air-Bag.

EEVC advocated that the EEVC and US approach is not contradictory, both are going through the 1st step.
Anyway a first step with two tests will imply difficulties in Europe due to type approval. EEVC confirmed his reserve about the two tests

Serious concerns were raised also by the OICA delegate about which 2nd test to consider more appropriate.

After confirmed the two steps approach the chairman went ahead into the discussion, asking about the outcomes of the researches led by the members.
Furthermore the previous table with the topics of interests was implemented with new commitments:

WORKING MATTERS	USA	CAN	EEVC	J	AUS
Trolley	X		X		
Type of barriers	X	X	X	X	X
-stiff	x	x	X		x
-deformable	x	x	X		x
Impact angle	X		X		
Dummy	X	X	X		X
5%ile female					
95%ile male					
Impact speed	X	X	X	X	X
Performance criteria	X	X	X	X	X
-footwell intrusion	x		X		x
-steering wheel intrusion	x		X		
-abdomen injury detection	x	x			
-arm injury	x	x			
Air-Bag performance	X	X			X
-Deployment time & effects		x			
Extension to vehicle of category N1.			X		

2) Working matters

a) Trolley (2nd step):
No relevant results are coming out about this issue from US research. Anyway in the group of compatibility a new side barrier is in progress to take into account the change of the vehicle fleet in US. The trend due to the increases of LTV, SUV, VANS is passed from 15% to 30% today and a 50% is expected for the next future in the market.
The risk of injury is 3-4 time in side impact when a light truck is involved. For the same reason the structure of the frontal impact test trolley has been reconsidered. The expert from Canada expressed same consideration.

b) Type of barriers (1st - 2nd step) :
The expert from US remarked that a different bumper, mass and size will be devised to match the vehicle fleet. Anyway for the first step the European barrier should be adopted by US as well.

Mr. Lowne introduced document IHRA-AFC 9A in which the main characteristics of fixed and mobile barrier are compared. The test, and the barrier as well, should be representative of all kind of accidents.

The representative of EEVC, with reference to document IHRA-AFC-16, remarked that the barrier must not represents all kind of cars but it might concern the most prominent characteristic of vehicle front faces and the way in which it will influence the future cars.

b) Impact angle (2nd step) :

The discussion has been controversial and conclusion are still far to be finalized. It is still premature to give any definition before to start with a deep assessment of car to car tests. At this aim a tide connection to the IHRA Compatibility group was recommended.

NHTSA studied extensively and categorized each test procedure with respect to its crash pulse and expected intrusion level. Findings of the analysis of each of the candidate test procedures with respect to their lead time, target populations, body regions addressed, and effect on compatibility has been report in the first part of the document from NHTSA numbered IHRA AFC-13.

The agency concluded that the continued use of the existing fixed barrier test in both the perpendicular mode and angles from 0 to 30 degrees remains most appropriate within the time-frame of the advanced air-bag regulatory actions.

c) Impact speed (1st - 2nd step) :

Based on real crash data NHTSA endorsed a velocity of 60 km/h for the first step. A second step velocity of 70 mph (112km/h) for the mobile barrier will be likely.

Canada advocated the same speed for the first step test but has not yet findings for the future second step.

Australia supported a move to increasing the impact test speed of ECE R 94/01 to 60 km/h.

EEVC underlined that higher speed increase stiffens and length of vehicles. As aftermath this increases the severity of low injury criteria in collision between stiffer and bigger cars against smaller cars.

Japan pointed out that decision on test speed depends on weight of vehicles. This have to encompass real travel speed and a representative vehicle curb weight. In support of this view document number IHRA-AFC-15 was released.

Mr. Oki concluded that the deformation and the injury criteria data of Car-to-Car crash test can be reproduced by the ODB test. To accurately reproduce the deformation and the injury criteria of Car to Car crash test for vehicles smaller or larger from each other, the collision speed of the ODB test must be adjusted.

d) Performance criteria (1st - 2nd step) :

NHTSA in this last spell is concerned about the risk of Air-Bag. The proposals of revised criteria focused on statistical measures, have been presented by the Agency in document IHRA-AFC 14. The report is a keen analysis of biomechanical data to define mathematical relationship that can discriminate the mechanical impact conditions under which various portions of the human body will or will not be injured.

Hollowell reported also an increased interest in developing the instrument lower part of the arm (ulna and radio fractures) to consider the effect of deploying air-bag as well. Even though the agency is interested in enhancing lower extremities for the dummy, no recommendation on this matter is included in the report.

Canada confirmed analogous commitment in their researches taking special regards to portions of human body involved in the air-bag deployment area (such as the lower arm part).

Mr. Hobbs said that it is about to define a geometric criterion for pedal intrusion. The criterion will allow the measure of initial and final position of the pedal and it will be adopted in N-CAP tests.

Mr. Seyer said that Australia supported some criteria, either geometric or injury based, for pedal intrusion.

e) Air-Bag performance (1st - 2nd step) :
Canada stated that the revision of the standard is going toward a depowered Air-Bag with a first step concerning the 5th % dummy with a speed of 40km/h.
The most relevant comments were said in the previous discussion concerning the other topics.

f) Extension to vehicle of category N1 (1st step) :
Mr. Lowne introduced the topic saying that two sub-group of vehicle of category N1 can be identified:

- Derived vehicles from category M1
- N1 specifically designed for transport of goods.

The first it is difficult to be restricted as a subgroup. On the second subgroup investigations are in progress to define the proper crash mode to test them. Namely N1 vs. N1 and N1 vs. M1. As a consequence a matching barrier structure is difficult to be redefined properly. Override is another problem introduced in extending the tests to N1 category.
Mr. Lowne suggested to ask to the compatibility group to give support to categorize N1 vehicles.

Conclusion
The chairman suggested to introduce tests only for vehicles derived by M1. In any case OICA was invited to collect data available overall the world to define N1 subgroups and at the same time the IHRA compatibility group secretariat will involve his group in this issue.

3) Comparative analyses method.

The discussion got through amending the former table 2 concerning the Trolley-based Frontal Offset Impact Test procedure:

ADVANTAGES	**ALTERNATIVE APPROACH TO ACHIEVE SAME ADVANTAGE WITH FIXED BARRIER**
1. The acceleration pulse, DV and energy distribution is representative of real world serious injuries.	No known alternative.
2. Takes into account the effects of the Mass Ratio of the	Change impact speed with vehicle mass.
3. Can include angular effects on the deformation and intrusion characteristics	No known alternative.
4. Can include a possible measure of Compatibility (by, for instance, measuring the vehicle and/or trolley acceleration).	Measure the force on the fixed barrier behind the deformable face.
Disadvantages	**POSSIBLE ACTIONS TO REDUCE THE DISADVANTAGE**
1. Complex test procedure for "moving barrier-moving car" (High speed trolley vibrations). Possible overriding	⎫ Reduce complexity by testing co-linearly and/or ⎭ using moving barrier to stationary car. Reduce the possibility of overriding.
2. Repeatability of more complex test may be poor (for angled moving barrier-moving car)	
3. Difficulties to viderecord impact effects between trolley and car.	Videorecord impact effects between mobile trolley and car. Reduce the possibility of overriding.
4. Limited number of test laboratories with capability to perform trolley - to -vehicle testing.	It depends by the complexity of the test and by the accuracy that the experts want achieve
5. Unknown ground and other interaction effects, especially if one vehicle stationary while the other travels at higher speed - to represent both vehicles moving.	Investigate
6. Need to agree on a harmonized barrier mass when vehicle fleet differs internationally.	Agree to differ

CONCLUSIONS

The chairman asked to the participants to examine all the documents distributed during the meeting in order to define the focal points and goals for the next session. Particular regards shall be given to 9A, which give an overview of the relative merits of having a fixed or variable mass trolley.

It was agreed that the next meeting will be held tentatively in the third week of February 1999. A second option could chosen in may in USA.

LIST OF CLASSIFIED DOCUMENTS

- **IHRA/AFC-8-Frontal impact research (K. Seyer).**
- **IHRA/AFC-9-Report on EEVC Activities in Support of IHRA Tasks (R. Lowne)**
- **IHRA/AFC-9a-Trolley Mass for a Mobile Barrier - Car Frontal Offset Impact Test (R. Lowne).**
- **IHRA/AFC-9b-Requirements for Selecting a Frontal Impact Deformable Barrier Face (C.A.Hobbs)**
- **IHRA/AFC-10-Determination of Frontal Offset Test Conditions based on crash data (S. Stucki, W.T.Hollowell)**
- **IHRA/AFC-11- Frontal Offset Crash Test study using 50th percentile male and 5th percentile female dummies (B.T.Park, R.M.Morgan, J.R.Hackney, J. Lee, S. Stucki, J. Lowrie).**
- **IHRA/AFC-11 A (B.T.Park, R.M.Morgan, J.R.Hackney, J. Lee, S. Stucki, J. Lowrie).**
- **IHRA/AFC-12- Offset test procedure development and comparison (C. L. Ragland)**
- **IHRA/AFC-13- Review of Potential Test Procedures for FMVSS No.208 (S. Stucki, W.T.Hollowell, H.C.Gabler, S. Summers, J. R. Hackney)**
- **Development of Improved Injury Criteria for the Assessment of Advanced Automotive Restraint Systems (M. Kleinberger, E.Sun, R. Eppinger, S. Kuppa, R. Saul).**
- **IHRA/AFC-15-Real Conditions of Japanese Road Traffic and Traffic Accident (K. Oki).**